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THE TEACHING AND APPLICATION OF MANUFACTURING TECHNIQUES AND PROCEDURES

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SUMMARY

The teaching and application of manufacturing techniques and procedures must be theoretically sound without being divorced from considerations of practical aspects. The manufacturing processes which have to be considered in this connection must be viewed less from the points of view of their immediate economic efficiency than from those of the operating conditions and the soundness of the product. Priority should be given to the study and application of those processes and procedures which are particularly suited to the prevailing climatic and living conditions, which are essential, easily taught and quickly applicable, and which at the same time cover the most urgent specific industrial needs. Special consideration should also be given to the fact that skilled and experienced operators are unlikely to be abundantly available during the initial period of industrial development.

The teaching and training must be approached on three levels, namely, the education of qualified engineers, the teaching of technicians, and the training of craftsmen.

At the academic level, the teaching should aim at bringing out the parameters which affect the production efficiency, and should cover the mechanism of the processes, the types and capacities of plant and equipment and the cost of installation, handling and maintenance. Some discussion of the fundamentals of engineering design, metallurgy and metrology must also be included, and the teaching must be backed by laboratory testing and research. The laboratories need not be filled with a great variety of plant and equipment. It is more important that the essential points of some typical processes under discussion are brought out.

Apart from those who are to introduce a process into industry, ensure its correct application, and keep its use and development in line with developments elsewhere, a large number of men and women must be taught how to plan and supervise the work whilst others must be trained in the operation of

the equipment. Great care must be taken not to overload the practical man with theoretical knowledge nor to expect the technician to become an accomplished craftsman. Demonstrations combined with explanations of the principal phenomena must be given in a laboratory to the technicians in order to acquaint them with the processes, the problems of equipment maintenance and the principles of supervising operatives and inspecting finished products. Some explanations of such phenomena may, of course, be given to technicians by means of practical exercises in the laboratory, and valuable use can also be made of visual aids, especially the many films which are now becoming available and which can often bring out the essential points more clearly than demonstrations. The future craftsman, on the other hand, who has to be trained in handling the types of equipment which he will be likely to use, must be enabled to practise extensively the actual operations in a suitable workshop.

A generous supply of text books is very important. If such books are based on translations, these must be carefully revised in order to take into account the state of economic development in the country where they are to be used.

As far as the selection of processes and techniques is concerned, it must be remembered that a shortage of skilled machine operators may make the use of automatic equipment advisable. This requires, however, good planners, skilled machine setters, and last but by no means least, a very good maintenance staff. Moreover, the raw material must be very thoroughly prepared when automatic processes are employed. The need for skill in operating machine tools can be reduced by the use of jigs and fixtures, and if there is a shortage of skilled tool makers the use of universal fixture systems will assist in producing the jigs and tools wh ch are essential for interchangeable manufacture. The manufacture of interchangeable components in turn helps to reduce the load on the skilled fitting staff. If such components can be produced in accordance with generally accepted standards, they can be used, if necessary in conjunction with imported components, thus easing difficulties which may be caused, for example, by the lack of certain equipment. Interchangeable manufacture is, however, only possible if the quality control is based on sound metrological principles, i.e. if suitable gauges are available and can be checked against reliable standards. This requires first class metrology equipment and, if possible, a standards room.

The whole life of a country, and not only one particular factory, is involved in the processes of production. It is, therefore, necessary to create facilities for training the population of the less developed areas so as to enable everybody to do his share in raising the country's productivity, and it is the duty of the more developed and industrialised countries to assist to the utmost the people in the less developed areas in reaching their goal.

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